

At pages 2-3 of the Office Action, the Examiner states that AAPA discloses all of the claimed features of applicants' invention except specifically disclosing "the connection of the auxiliary output ports of the first optical matrix switch to the input ports of the third optical matrix switch, the connection of the output ports of the second optical matrix switch to the auxiliary input ports of the third optical matrix switch, the connection of the output ports of the first optical matrix switch to the auxiliary input ports of the fourth optical matrix switch, and the connection of the auxiliary output ports of the second optical matrix switch to the input ports of the fourth optical matrix switch." The Examiner then alleges that since "Kashima discloses an optical cross-connect apparatus where switches are crossed for the expansion of input and output (fig. 1)...it would have been obvious to one of ordinary skill in the art at the time the invention was made to have configured the connection of the auxiliary output ports of the first optical matrix switch to the input ports of the third optical matrix switch, the connection of the output ports of the second optical matrix switch to the auxiliary input ports of the third optical matrix switch, the connection of the output ports of the first optical matrix switch to the auxiliary input ports of the fourth optical matrix switch, and the connection of the auxiliary output ports of the second optical matrix switch to the input ports of the fourth matrix switch since one would be motivated to reduce signal loss (col. 1, lines 66-67). Furthermore, one skilled in the art fully acknowledge that the essence of cross connecting switches increases the maximum number of possible combinations of switching elements, ultimately shortening the switching response time (col. 1, lines 24-26) as the combination of input and outputs is expanded."

First, Applicants agree with the Examiner that AAPA (the admitted prior art of FIGS. 13A and 13B of the instant application) does not teach or suggest, among other things, "the connection of the auxiliary output ports of the first optical matrix switch to the input ports of the third optical matrix switch, the connection of the output ports of the second optical matrix switch to the auxiliary input ports of the third optical matrix switch, the connection of the output ports of the first optical matrix switch to the auxiliary input ports of the fourth optical matrix switch, and the connection of the auxiliary output ports of the second optical matrix switch to the input ports of the fourth optical matrix switch." Moreover, applicants respectfully submit that contrary to the assertions made by the Examiner, the cross-connection apparatus by Kashima is not the same as the optical switch apparatus recited in the present invention, nor could it provide the same operation or results of applicants' invention as recited. More specifically, it is respectfully submitted that with the cross-connection apparatus of Kashima, there are always some paths (depending on the order in which the paths are set in) that cannot be set even when the output

ports are open. In other words, although Kashima enables paths to be set by only routing signals through two optical switches, blocking will always occur within some of the paths. Accordingly, the number of signals that can be transmitted is limited. This blocking occurs since the apparatus by Kashima does not provide any reserve/auxiliary ports. For example, in referring to FIG. 5 of Kashima, when the optical switch S1 performs a switching operation, it can be seen that the connection path between input 3 and output 3 of S1 is not operational, since the signal path from input 3 of S1 is already dedicated to output 2 of S1. In other words, after the paths are set from IN1-1 to OUT2-3, from IN1-2 to OUT2-1, and from IN1-3 to OUT1-2, the path from IN3-1 to OUT1-3 cannot be set due to a blocking which occurs in the path.

Accordingly, the switch in Kashima, in contrast to the switch recited in the present invention, is not a non-blocking switch, and therefore functions differently than the switch of the present invention. Stated differently, it is respectfully submitted that Kashima does not teach or suggest, among other things, "an optical switch comprising first to fourth optical matrix switches wherein a plurality of 2-input/2-output optical switch elements are arranged in a matrix to form a plurality of input ports, a plurality of auxiliary input ports, a plurality of output ports, and a plurality of auxiliary output ports, comprising the steps of: respectively connecting said auxiliary output ports in the first optical matrix switch to said input ports in the third optical matrix switch; respectively connecting said output ports in the second optical matrix switch to said auxiliary input ports in the third optical matrix switch; respectively connecting said output ports in the first optical matrix switch to said auxiliary input ports in the fourth optical matrix switch; and respectively connecting said auxiliary output ports in the second optical matrix switch to said input ports in the fourth optical matrix switch," as recited in independent claim 1 of applicants' invention. Further, it is respectfully submitted that Kashima does not teach or suggest, among other things, "an optical switch comprising first to fourth optical matrix switches wherein a plurality of 2-input/2-output optical switch elements are arranged in a matrix to form a plurality of input ports, a plurality of auxiliary input ports, a plurality of output ports, and a plurality of auxiliary output ports, and wherein: said auxiliary output ports in the first optical matrix switch are respectively connected to said input ports in the third optical matrix switch; said output ports in the second optical matrix switch are respectively connected to said auxiliary input ports in the third optical matrix switch; said output ports in the first optical matrix switch are respectively connected to said auxiliary input ports in the fourth optical matrix switch; and said auxiliary output ports in the second optical matrix switch are respectively connected to said input ports in the fourth optical matrix switch," as recited in independent claim 2 of applicants' invention.

Finally, it is respectfully submitted that Kashima does not teach or suggest, among other things, "An optical crossconnecting apparatus comprising: a plurality of optical demultiplexing means for demultiplexing, on a wavelength basis, input light so as to be output from a plurality of output ports; a plurality of optical multiplexing means for wavelength-multiplexing light which have been input to a plurality of input ports; and an optical switch, and wherein: said optical switch comprises first to fourth optical matrix switches wherein a plurality of 2-input/2-output optical switch elements are arranged in a matrix to form a plurality of input ports, a plurality of auxiliary input ports, a plurality of output ports, and a plurality of auxiliary output ports, said auxiliary output ports in the first optical matrix switch are respectively connected to said input ports in the third optical matrix switch; said output ports in the second optical matrix switch are respectively connected to said auxiliary input ports in the third optical matrix switch; said output ports in the first optical matrix switch are respectively connected to said auxiliary input ports in the fourth optical matrix switch; said auxiliary output ports in the second optical matrix switch are respectively connected to said input ports in the fourth optical matrix switch; said input ports in said optical switches are connected to a plurality of output ports in said optical demultiplexing means; and said output ports in said optical switches are connected to a plurality of input ports in said optical multiplexing means," as recited in independent claim 7 of applicants' invention.

In view of the above points, it is respectfully submitted that it would not have been obvious to combine the teachings of the admitted prior art at FIGS. 13A and 13B with Kashima to provide to invention as recited in independent claims 1, 2 or 7 of applicants' invention. It is respectfully submitted that to establish a *prima facie* case of obviousness, three basic criteria articulated in **M.P.E.P. §2142** must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all of the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on Applicant's disclosure." In re Vaeck, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991). See also MPEP section 2142 (Establishing a *prima facie* case of obviousness).

Applicants respectfully submit that the Examiner has not established a *prima facie* case of obviousness with respect to claims 1, 2 or 7 of applicants' invention since there is no suggestion or motivation in either the admitted prior art at FIGS. 13A and 13B or Kashima

themselves or in the knowledge available to one skilled in the art, absent applicants' own disclosure, to combine the documents in a manner suggested by the Examiner. Further, even assuming that one skilled in the art would have been motivated to combine the admitted prior art at FIGS. 13A and 13B with Kashima, it is respectfully submitted that for the reasons stated above, this hypothetical combination would not teach or suggest the present invention as recited in independent claims 1, 2 or 7 of applicants' invention.

For at least the above reasons, it is respectfully submitted that independent claims 1, 2 and 7 of applicants' invention are allowable over the admitted prior art at FIGS. 13A and 13B and Kashima, separately, or in combination thereof, and withdrawal of this rejection and allowance of these claims are earnestly solicited. Further, for at least the reason that claims 5-6 depend from allowable independent claim 1, and therefore incorporate all of the features recited therein, it is respectfully submitted that these claims are also allowable.

Claims 3 and 4 were rejected under 35 U.S.C. §103(a) as being anticipated over Applicant's Admission of Prior Art (AAPA) in view of Kashima and further in view of Shimomura et al. (US 6,347,168). This rejection is respectfully traversed for the reasons stated below.

It is respectfully submitted that as pointed out above, independent claim 2 is allowable over both the admitted prior art at FIGS. 13A and 13B and Kashima, separately, or in combination thereof. Further, since claims 3 and 4 depend from allowable independent claim 2, these claims are also allowable over the admitted prior art at FIGS. 13A and 13B and Kashima. Finally, it is respectfully submitted that since the Examiner is relying on Shimomura et al. for the limited purpose of providing "an optical switch system with optical switches that are cross-bar optical matrix switches having switching elements that are semiconductor optical switches," while not teaching or suggesting any of the features recited in independent claim 2, as stated above, which are missing from both the admitted prior art at FIGS. 13A and 13B and Kashima, claims 3 and 4 are allowable over each of the admitted of prior art (AAPA), Kashima and Shimomura et al., separately, or in combination thereof, and withdrawal of this rejection and allowance of these claims are earnestly solicited.

New Claims

It is respectfully submitted that new claims 8 and 9 are allowable over the admitted prior art and Kashima, separately, or in combination, for at least the reason that neither the admitted prior art nor Kashima teach or suggest, among other things, "an optical switch comprising: first to fourth optical matrix switches, wherein a plurality of 2-input/2-output optical switch elements are arranged in a matrix to form a plurality of input ports, a plurality of auxiliary input ports, a plurality of output ports, and a plurality of auxiliary output ports, said auxiliary output ports in the first optical matrix switch being respectively connected to said input ports in the third optical matrix switch, said output ports in the second optical matrix switch being respectively connected to said auxiliary input ports in the third optical matrix switch, said output ports in the first optical matrix switch being respectively connected to said auxiliary input ports in the fourth optical matrix switch, said auxiliary output ports in the second optical matrix switch being respectively connected to said input ports in the fourth optical matrix switch, said input ports in said optical switches being connected to a plurality of output ports in said optical demultiplexing units; and said output ports in said optical switches being connected to a plurality of input ports in said optical multiplexing units," as recited in new independent claim 8, or "[a]n optical switch to receive and output at least sixteen signals, comprising: four nxn optical matrix switches, each having at least sixteen 2-input/2-output optical switch elements arranged in a matrix and providing that two of the four optical matrix switches receive at least sixteen input signals, the four nxn optical matrix switches being connected to form four input ports, four auxiliary input ports, four output ports, and four auxiliary output ports such that each of the sixteen optical signals received passes through no more than two of the four nxn optical matrix switches to provide one of sixteen output signals output by the other two of the four optical matrix switches," as recited in new independent claim 9.

CONCLUSION

There being no further outstanding objections or rejections, it is submitted that the application is in condition for allowance. An early action to that effect is courteously solicited.

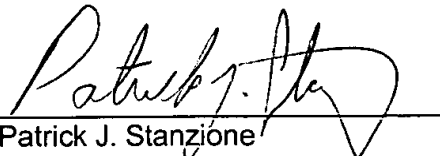
Finally, if there are any formal matters remaining after this response, the Examiner is requested to telephone the undersigned to attend to these matters.

If there are any additional fees associated with filing of this Amendment, please charge the same to our Deposit Account No. 19-3935.

Respectfully submitted,

STAAS & HALSEY LLP

Date: MARCH 13, 2003

By: 
Patrick J. Stanzione
Registration No. 40,434

700 Eleventh Street, NW, Suite 500
Washington, D.C. 20001
(202) 434-1500



VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE CLAIMS:

Please ADD the following claims:

8. (NEW) An optical cross-connecting apparatus comprising:
a plurality of optical demultiplexing units to demultiplex, on a wavelength basis, input
light to be output from a plurality of output ports;
a plurality of optical multiplexing units to wavelength-multiplex light input to a plurality of
input ports; and
an optical switch comprising:
first to fourth optical matrix switches, wherein a plurality of 2-input/2-output optical
switch elements are arranged in a matrix to form a plurality of input ports, a plurality of auxiliary
input ports, a plurality of output ports, and a plurality of auxiliary output ports, said auxiliary
output ports in the first optical matrix switch being respectively connected to said input ports in
the third optical matrix switch, said output ports in the second optical matrix switch being
respectively connected to said auxiliary input ports in the third optical matrix switch, said output
ports in the first optical matrix switch being respectively connected to said auxiliary input ports in
the fourth optical matrix switch, said auxiliary output ports in the second optical matrix switch
being respectively connected to said input ports in the fourth optical matrix switch, said input
ports in said optical switches being connected to a plurality of output ports in said optical
demultiplexing units; and said output ports in said optical switches being connected to a plurality
of input ports in said optical multiplexing units.

9. (NEW) An optical switch to receive and output at least sixteen signals,
comprising:

four nxn optical matrix switches, each having at least sixteen 2-input/2-output optical
switch elements arranged in a matrix and providing that two of the four optical matrix switches
receive at least sixteen input signals, the four nxn optical matrix switches being connected to
form four input ports, four auxiliary input ports, four output ports, and four auxiliary output ports
such that each of the sixteen optical signals received passes through no more than two of the
four nxn optical matrix switches to provide one of sixteen output signals output by the other two
of the four optical matrix switches.

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